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### Abstract

In the normal operation of quadrupole ion trap mass spectrometers, the trapped ions are ejected symmetrically through both the upper (detector) and lower (source) endcap electrodes during mass selective boundary ejection experiment. This reduces the sensitivity of the instrument by almost 50%. In this preliminary study, we altered the geometry parameters of the quadrupole ion traps to introduce asymmetry. The asymmetry displaced the ion cloud towards the detector endcap which resulted in a preferential ejection through this endcap, thus imparting directionality to the ejected ions and hence to the sensitivity enhancement.

Two symmetrical mass analyzers have been taken up for numerical study. They include the Paul trap (QIT) and the cylindrical ion trap (CIT). Asymmetry to these geometries is introduced in two ways, one by varying the upper endcap hole radius alone and in other by stretching the trap along the upper endcap only. The escape velocity plots and mass selective boundary ejection simulations are used to demonstrate the directionality of ion ejection for these geometries. The simulations revealed a significant increase in the number of ions getting ejected in the direction of asymmetry.